

1990 Clean Air Act Impact on Shipyard Painting Operation

U.S. DEPARTMENT OF TRANSPORTATION
Maritime Administration and the U.S. Navy

in cooperation with

National Steel and Shipbuilding Company
San Diego, California

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**1990 CLEAN AIR ACT
IMPACT ON SHIPYARD
PAINTING OPERATION**

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FOR

**THE NATIONAL SHIPBUILDING
RESEARCH PROGRAM**

**U.S. DEPARTMENT OF TRANSPORTATION
MARITIME ADMINISTRATION AND THE
U.S. NAVY**

IN COOPERATION WITH
NATIONAL STEEL AND
SHIPBUILDING COMPANY

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EXECUTIVE SUMMARY

This report gives the necessary background information on the Clean Air Act to cover the CTG (Control Techniques Guideline) for Shipbuilding and Ship Repair which is required to be promulgated by EPA (Environmental protection Agency) by November 15, 1993. It also explains how to interface With federal, state, and local regulators in regard to establishing air pollution rules and regulation as they relate to VOC's (Volatile Organic Compounds). The past, current and proposed efforts by the U.S. Navy concerning VOC's is also covered (courtesy of Dr. A. Kaznoff).

VOC IMPACT ON SHIPBUILDING

I. Introduction

The purpose of this paper is to give a brief description of those portions of the Clean Air Act of 1990 which will affect the shipbuilding industry. The paper will continue with a brief description of the involvement of the U.S. Navy in the process of modifying their activities to allow overall attainment of the goals of the Clean Air Act. This will be followed by commentary concerning working with the Environmental Protection Agency (EPA) to formulate a Control Technique Guideline (CTG) for the Shipbuilding and Ship Repair Industry for Volatile Organic Compounds (VOC's) and PM₍₁₀₎ (Designator for "Particulate Matter"). Finally, this report will cover those activities which members of the Shipbuilding Industry should pursue with the local/state regulators in order to utilize the CTG with the local/state regulators as a part of the State Implementation Plan (SIP) to achieve the goals of the Clean Air Act.

In 1976 the San Diego Air Pollution Control District embarked upon the writing of Regional Air Quality Strategies (RAQS) as the first step in developing tactics for inclusion in the State Implementation Plan for California. The purpose of the State Implementation Plan was to outline those activities involving specific tactics which the Air Pollution Control District intended to use to achieve the California Ambient Air Quality Standards (CAAQS). Several San Diego shipyards and boatyards, shipyard worker's unions, paint suppliers and ship owner/operators closely followed the activities of the SDAPCD and the Air Quality Advisory Groups which were involved in formulating the RAQS. The Community Resources Panel (CRP) and the San Diego Association of Governments (SANDAG) were the two most active advisory and planning organizations involved in the RAQS. The first RAQS in the California SIP included marine coatings as a category within the miscellaneous metal parts and products Tactic. For various reasons, marine coatings were exempted from regulation. In the early 1980's, the RAQS were again revisited and the marine coatings were continued in their exempted status based upon the activities started by the coating manufacturers in the early 70's to reduce the VOC content of the coatings used on marine vessels. In the mid 1980's, because most of the other stationary source Tactics had been exhausted as a means of reducing VOC's, marine coatings systems once again came under close scrutiny by the regulators. During 1986 and 1987 a marine coatings rule was being formulated in the South Coast Air Quality Management District (SCAQMD), the Bay Area Air Quality Management District (BAAQMD) and in the San Diego Air Pollution Control District (SDAPCD). Once again, as was the case in 1976, the parties mentioned above with the additional strength of the U.S. Navy worked with the regulators involved to formulate a marine coatings rule which would benefit the environment and move toward attainment of

the State and National Ambient Air Quality Standard (NAAQS) while still allowing the shipbuilding industry to have acceptable coating systems which would protect marine vessels. On September 1, 1989, the BAAQMD put the first marine coatings rule into effect for their district. The SCAQMD and the SDAPCD followed suit by passing marine coatings rules shortly thereafter.

The scope of this report is, as noted above, to give a brief overview of the Clean Air Act of 1990, and indicate the current Navy involvement with marine coatings. Then to generally cover the methods which have been used by the shipbuilding industry to work with the local and state regulators. Finally, the program being contemplated to effectively interface with EPA regarding the Shipbuilding and Ship Repair CTG will be covered.

II THE CLEAN AIR ACT OF 1990

The first Clean Air Act was passed by congress and signed by the President in 1970. It included ambient standards designated as National Ambient Air Quality Standards (NAAQS), State Implementation plans (SIP's) and deadlines for attainment of the NAAQS. The Clean Air Act was last amended in 1977. The main items covered were New Source Review (NSR), Reasonably Available Control Technology (RACT) which was to be used as the level of control required in Control Technique Guidelines (CTG's) for existing sources. New deadlines to attain the NAAQS were also set in this 1977 amendment. The basic approach was that "one-size-fits-all". In other words, any city or area which was not in attainment with any one of the NAAQS had to meet all of the requirements of the Clean Air Act. As will be seen later in this report, the new Clean Air Act which was passed on November 15, 1990, uses a graduated approach depending upon how far out of compliance with a given NAAQS standard the area in question is. The United State Senate passed their original version of the new Clean Air Act on April 3, 1990. The house passed their version on May 23, 1990. A conference committee was convened early in July, 1990. The final bill which came out of the conference committee was passed by the House on October 26, 1990, and then by the Senate the next day, October 27, 1990. President Bush signed this bill into law on November 15, 1990.

On November 15, 1990, a twenty year clock started ticking to get the nation to a point that all cities within the United States will meet the NAAQS. There are literally hundreds of interim deadlines to be met by the local regulators, the state regulators and the federal regulators. A document was published on January 15, 1991 entitled "Implementation Strategy for the Clean Air Act Amendments of 1990". This document is available upon request from the Environmental Protection Agency (EPA). It is estimated that the 1990 amendment to the Clean Air Act will cost in excess of \$25,000,000,000. Some estimates of the annual cost run as high as \$50,000,000,000.

The key provisions of the Clean Air Act amendments of 1990 are shown on chart I. Title I deals with non-attainment in general and with stationary sources in particular for non-attainment of the National Ambient Air Quality Standards (NAAQS). It is the provision of the act with which most of the remainder of this report will deal. There are some comments concerning hazardous air pollutants which are contained in Title III. There are also a few comments on permitting and enforcement.

This report is limited to one of the NAAQS: SMOG. The smog levels are measured as the presence of ozone: O³. One occurrence is allowed per year greater than .12 Parts Per Million (PPM) average over a one hour period. There are approximately one hundred cities currently not in compliance for the NAAQS for smog. One of the first things that Title I deals with in the amendments to the Clean Air Act of 1990 is having EPA and the States determine jointly what the boundaries are for the non-attainment areas and at what level of attainment they are to be classified. Under the provisions of the 1990 Clean Air Act amendments “One size does NOT fit all”. The classifications for non-attainment for ozone are: Marginal, Moderate, Serious, Severe 1, Severe 2 and finally Extreme.

Chart II in appendix A shows the non-attainment area classifications. The Marginal areas are based upon ozone concentrations greater than .121 up to .138 parts per million. They are required to get into attainment within three years. Areas classified as moderate are between .138 to .160 parts per million and must be in attainment within 6 years. Likewise, serious areas are between .160 to .180 parts per million and must be in attainment within 9 years. Severe 1 classifications are from .180 to .190 and must be in attainment within 15 years. Severe 2 are between .190 to .280 parts per million and are allowed an additional 2 years for attainment. The extreme classification is over .280 parts per million and those areas are allowed 20 years to get into attainment with the NAAQS. Currently, the only area in the extreme classification is the Los Angeles Air Basin which is controlled by the South Coast Air Quality Management District, the State of California Air Resources Board, and of course EPA under the Clean Air Act Amendments of 1990. The L.A. basin is the most challenging area for the regulators. It is extremely important because 12,000,000 people live in the basin: about 5% of the total U.S. population.

In order to meet the requirements for the ozone standard EPA had promulgated 29 CTG's. The 1990 amendments to the Clean Air Act require EPA to promulgate 11 more CTG's based upon the specific category's contribution to the ozone problem; i.e., the next 11 worst smog producers. Two more CTG's are mandated by the Clean Air Act amendments: Aerospace coatings and shipbuilding/ship repair coatings. Specifically, the CTG for shipbuilding/ship repair coatings must be promulgated by EPA within 3 years: November 15, 1993. Within the guidelines of this CTG EPA is to provide for scheduled reductions within 10 years after the CTG is issued: as late

as November 15, 2003. However, it should be noted that this timing is at the discretion of EPA, They could issue a CTG before November 15, 1993 and could put controls into effect before November 15, 2003. The CTG is to address both VOC's and particulate matter, PM₍₁₀₎.

Before leaving the description of the segments of the Clean Air Act, Title III, Hazardous Air Pollutants will be covered briefly. There are approximately 750 source categories which have already been identified by EPA which must be regulated within the next 10 years. Coke ovens plus 40 of the worst source categories are to be regulated within the next 2 years. These again are specific stationary source categories. As many "Area Sources" as are required to insure that 90% of the 30 most serious pollutants are regulated is also required. Retail fuel outlets and drycleaners are two examples of "Area Sources". Some familiar items in the current list of 189 Hazardous Air Pollutants are: methyl chloroform, toluene, xylene, benzene and glycol ethers. Hopefully, from the standpoint of marine structures, the reductions of VOC's will be synergistic to meeting the requirements of Title III for Hazardous Air Pollutants.

The foregoing has been an extremely brief overview of the principal portions of the Clean Air Act which will effect the shipbuilding and ship repair industry. Title I and Title III were covered. Title V concerning permitting of sources at the federal level and Title VII regarding enforcement will effect the marine industry as may a few of the other Titles of the Clean Air Act amendment of 1990. However, the subject of this report is the affect of VOC's on shipbuilding. Thus, although many of the other provisions are onerous, they are not covered in this paper.

Before going into a description of what the Navy is currently doing in the area of VOC's, the implementation principles for the Clean Air Act amendments of 1990 which have been promulgated by EPA will be covered briefly, since it is EPA with whom we must work to implement the provisions of the Clean Air Act amendments. Chart III in appendix A shows the implementation principles for the Clean Air Act as promulgated by EPA. For our purpose in working with EPA the comment concerning consultation to build consensus for the Clean Air Act should be noted. EPA intends to "conduct early and frequent discussions for interested parties, including other government organizations, industry, environmental groups and academics. Where appropriate, use negotiation techniques to resolve critical issues." As noted at the beginning of this paragraph we will be returning to the issue of consultation and working with EPA after we review what the U.S. Navy is doing in regard to VOC'S and the Marine Coatings Rules.

III. U.S. Navy Involvement

Dr. Alex Kaznoff of the Naval Sea Systems Command (NAVSEA) has been active in this area for a considerable amount of time. Dr. Kaznoff participated in work shops in the Bay Area Air Quality Management district (BAAQMD) during the formulation of the Marine Coating's Rule for that Air Quality Management District. Dr. Kaznoff has graciously allowed the shipbuilding industry to use his DRAFT documents concerning the Navy's involvement in the VOC reduction program. The information presented here is, as indicated, at the DRAFT level only. Thus, the Navy is still formulating their overall program. Currently, the basic DRAFT program goals are to reformulate the coating systems. The Navy expects to either equal or improve the overall service life performance of these reformulated coatings. The Navy wishes to take care that they do not decrease the quality of the coating systems. They also want to insure that there is no increase in the frequency of painting, any increase in the overall environmental impact, or that there is any increase in the overall application and removal cost for these newly formulated coating systems. From chart IV in appendix A you will note that of the types of systems most widely used by the Navy, Alkyd Coatings for ships interiors and exterior freeboard range between 380 and 780 grams per liter. The target is 340 grams per liter for these Alkyd Coatings. Epoxy coatings used on the exterior, interior and immersion areas currently range between 200 and 410 grams per liter. The current target is 340 grams per liter. Copper based anti-fouling coatings for use on the underwater hull surfaces currently range between 283 and 440 grams per liter. The current target is 440 grams per liter being reduced finally down to 340 grams per liter.

During 1989 the Navy has completed reformulation of anti-corrosive epoxies (MIL-P-24441). Silicone Alkyd (DOD-E-24635) and camouflage paint (F-184 per DOD-P-24631, flexible epoxy dark gray) have also been reformulated. During 1989 the Navy completed preliminary reformulations for replacements of vinyl zinc chromate primer (F-120PER MIL-P-15930) and chlorinated alkyd, interior use (F124 PER DOD-E-24607).

During 1990 the Navy did an evaluation of shipboard anti-corrosive epoxy and silicone alkyd top coats. They also did shipboard service testing of dark gray flexible epoxy. Fleet evaluation by NAVMEDCOM of water based acrylic top side paints plus the reformulation of non-skid flight deck coatings was also accomplished. Finally during 1990 the reformulation and laboratory fire testing of chlorinated alkyd coatings was completed.

This year, 1991, the Navy intends to do the final lab and fleet evaluations of anti-corrosive epoxy and silicone alkyd paints. They will need fleet approval of both of these paints. They also intend to issue the approval of camouflage paint. They

expect to get fleet approval of water base acrylic topside paints for “whole ship application”. Approval should also be issued for non-skid coatings. Along with this, the fire tests should be completed and approved for chlorinated alkyd. Finally they hope to either cancel and/or consolidate most of the paint specifications.

In summary the Navy has modified a substantial number of their paints already. This has been done as fast as is feasible with the available technology recognizing the constraints of current regulations. The overall objective of the Navy is to stimulate their suppliers to meet the VOC standards with fully tested and proven, VOC complaint, exterior and interior paints. Based upon the foregoing information the remainder of this report will deal with the subjects of working with EPA on the CTG and finally working with YOUR state/local regulators.

IV. WORKING WITH EPA ON THE SHIPBUILDING CTG.

EPA intends to have early and frequent discussions with all interested parties. Where appropriate, they intend to use negotiation techniques to resolve critical issues. This statement mirrors the philosophy that Jim Ruecker, past Chairman of the Society of Naval Architects and Marine Engineers (SNAME) SP-3 panel, Surface Preparation and Coatings, used in his relationships with the local and state regulators during the development of the “California Marine Coatings Rules”.

EPA will be developing and then promulgating a Marine Coatings “Control Technique Guideline” (CTG) for shipbuilding and ship repair for VOC’s and PM₍₁₀₎ over the next two and one half years: due by November 15, 1993. The industry individuals who should be involved are the owners and operators of the ships, the applicators (both shipyards and the blast and paint contractors), the suppliers: paint companies, abrasive companies, resin and other raw materials companies. If we fail to get involved we will be our own worst enemy. It is imperative that customers, applicators and suppliers be involved during the formulation of the CTG. It is expected that EPA will “probably” be using “WORK SHOPS to get input from all concerned parties including other governmental bodies, environmentalist and academics. These early informal meetings will be held to gather information. The actual process which will be used by EPA for regulatory development is shown on chart V in appendix A. What we need to do as an industry is:

GET THE FACTS

FACE THE FACTS

DO THE RIGHT THING

v. WORKING WITH YOUR LOCAL/STATE REGULATORS

Assuming we all do our part and we get a good workable marine coatings CTG, now what do we do?

Armed with all the background information gained from working with EPA during the development of the CTG, start the process all over again at the local level (AQMD, APCD and/or State AIR BOARD). Your local regulators will react to the federal Clean Air Act CTG by implementing an air pollution control ordinance for Marine Coatings and PM₁₀ or possibly by leaving it out of their RAQS. This will become a tactic in their Regional Air Quality Strategy (RAQS) if they feel it is required. Keeping this comment in mind, depending upon the severity of the area in which you are located from the stand point of non-attainment with the smog NAAQS, your area may or may not require (as noted above) the Marine Coatings rule as one of their tactic in their RAQS. The RAQS are made up of many tactics like the Marine Coatings tactic/rule. The AQMD selects those tactics from the Regional Air Quality Strategy which they feel are best suited for their area to bring it into compliance. They then submit those tactics to their state in a document called a "State Implementation Plan" (SIP). The SIP is a state's plan (and proof) that they will take the required actions to come into compliance with the National Ambient Air Quality Standards (NAAQS). There are basically three different types of Regional Air Quality Strategies: Land use strategies (made up of specific tactics), mobile/transportation strategies (made up of tactics) and stationary source strategies (made up of tactics). Examples of land use tactics are: zoning changes, slow growth initiatives and many others. The mobile/transportation tactics deal with the vehicular tactics. Examples are automobile/truck/bus emission standards for their interior combustion engines, bike paths to encourage bicycling to and from work or other transportation trips in lieu of using an automobile, plus car pooling, public transit, vehicle inspection and maintenance programs (smog checks) and many others. From the standpoint of industry, the stationary source tactics are those which effect us and our companies specifically. Examples of stationary source tactics are: Marine Coatings, Large commercial bakeries, vapor controls (retail gas stations), vapor controls (institutional/industrial/government gas stations), vapor controls (tank farms), tanker's ballasting (ships), charcoal lighter (for sunday barbecues), lawn mower controls, polymer and resin manufacturers and many others. In fact, air quality tactics for the South Coast Air Quality Management District are shown on charts VI VII, VIII and IX in appendix A. Since, as noted previously, the South Coast Air Quality Management District covers the Los Angeles Air Basin, the list of tactics shown for the South Coast Air Quality Management District is probably the most exhaustive list of stationary source tactics available today. You will notice from the column showing the cost effectiveness and dollars per pound that many of these tactics are extremely expensive. California will have to use many tactics which are difficult and expensive to implement. However, many of you live in "Attainment Areas" that are designated as "MODERATE", "SERIOUS" or "SEVERE" and your

AQMD/STATE will only have to implement SOME of these tactics to have your area be able to come into compliance by the deadlines specified in the Clean Air Act Amendments of 1990. You should note that the land use and the mobile/transportation tactics which are developed by the federal government and the state governments may go far in getting your areas into compliance with the National Ambient Air Quality Standards (NAAQS).

You should be finding out what the designator is for your attainment area. Are you in a marginal, moderate, serious or severe area? Do you know what the RAQS look like for your local area? What RAQS tactics are being used in your area to meet NAAQS?

Although the following information is strictly the author's opinion, it is presented for your consideration. You should remember that automobiles (Vehicles in general) are the number one cause of smog and the tactics to control emissions from the vehicle sources like the inspection and maintenance tactic or the vapor control tactics can achieve large reductions in your area. You should explain the Marine Coatings EPA CTG to your local and state regulators so that they understand what it is and how it is to be used. You should be helping them formulate a Marine Coatings Rule tailored to your local weather conditions. A considerable amount of ground work has already been laid with EPA to indicate that areas with very cold temperatures or high relative humidity will have to be allowed to thin the standard coatings systems which are being used in California. Many of the systems which are very low in VOC's would be impossible to use in extremely cold temperatures. From the same standpoint, many of the systems which are water based would be extremely difficult to use in areas of high relative humidity. **THE AUTHOR IS NOT AN EXPERT IN COATINGS SYSTEMS APPLICATION IN COLD OR HUMID AREAS.** Thus, it is imperative that you, the industry experts take the time to develop the guidance for the amount of dilution which is necessary for cold temperatures and for high relative humidity and pass this information on to EPA in order that they can incorporate it into their CTG.

You need to know the following things about your local area.

- o Am I located in a non-attainment area?
- o If yes, for what pollutants?
- o If yes, for any pollutant, at what level of severity?

MARGINAL, MODERATE, SERIOUS, SEVERE, EXTREME?

- o What tactics are the local/state regulators thinking about using?
 - o Do they affect me?
 - o Are there other tactics which make more sense?

- o What are the costs of the tactics in dollar per pound of pollutant eliminated?
- o How many tons of pollutant must the state/local regulators eliminate in your AQMD/APCD?

It is incumbent upon you to find out what your local tactics are. You need to know what they cost in \$/pounds of pollutant reduced. You also need to find out if they have been successful in other areas. If you are told they have been successful, it is a good idea to verify their success in the specific area that is given to you as a reference. Finally and possibly most importantly, as an honest broker, you need to make sure that they make environmental sense. Does the tactics appear to clean the air, but pollute the land or water? Will the tactic require so much energy that the local power plant pollutes more than you will save in pollution? Will it require you to perform the polluting act more often thus negating any savings from that tactic: e.g., coat a ship once a year with a lower VOC coating which will only last one year versus a slightly higher VOC coating which will last for three or four years.

The other thing that you need to understand so that you do not “paint yourselves into a corner” is how your production operation functions. Have you talked with Production, your customer, your suppliers and any other interested/effectuated parties? Have you asked them what effect a given tactic will have? Are you sure you know what your company can and can not live with? Are you familiar enough with the tactics and the Regional Air Quality Strategies in general that you recognize where you can make environmental concessions and thus have a “WIN/WIN” situation?

The punch line to this entire presentation is:

GET THE FACTS

FACE THE FACTS

DO THE RIGHT THING

APPENDIX A

KEY PROVISIONS OF CAA (1990)

Title I	Non-Attainment Generally & Stationary Sources
Title II	Mobile Sources and Fuels
Title III	Hazardous Air Pollutants
Title IV	Acid Rain
Title V	Permitting
Title VI	Stratospheric Ozone
Title VII	Enforcement
Title VIII	Miscellaneous
Title IX	Research
Title X	Disadvantaged Businesses
Title XI	Displaced Workers

CHART I

NON-ATTAINMENT AREA CLASSIFICATIONS

	AREA CLASS	REQUIRED OZONE CONCENTRATION ATTAINMENT DATE	
		<u>PPM (Parts/Million)</u>	<u>(After Enactment)</u>
CHART II 12	Marginal	,121 to .138	3 Years
	Moderate	.138 to .160	6 Years
	Serious	.160 to .180	9 Years
	Severe 1	.180 to .190	15 Years
	Severe 2	.190 to .280	17 Years
	Extreme*	.280 and above	20 Years

* Los Angeles Air Basin (SCAQMD): 12,000,000 People (1987)

SCAQMD: South Coast Air Quality Management District, which contains Los Angeles, is the only area in the United States classified as "EXTREME" under the 1990 CAA.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

**IMPLEMENTATION PRINCIPLES
FOR THE CLEAN AIR ACT AMENDMENTS OF 1990**

OFFICE OF
AIR AND RADIATION

PROMISE OF THE CLEAN AIR ACT

- o “Every American expects and deserves to breathe clean air...”
President Bush
- o These principles will guide us as we turn the promise of the Act into a legacy of clean air.

POLICY

- o E³: Achieve and maintain a healthy environment, while supporting strong and sustainable economic growth and sound energy policy.
- o Market-based: Use market-based approaches and other innovative strategies to creatively solve environmental problems.

BUILD CONSENSUS

- o Joint Venture Recognize the essential role played by state and local governments.
- o Consultation: Conduct early and frequent discussions with interested parties, including other government organizations, industry, environmental groups, and academics. Where appropriate, use negotiation techniques to resolve critical issues.
- o Federal Coordination: Work closely with other EPA offices, other Federal agencies, and Congress to ensure a coordinated approach that will achieve environmental objectives in the most efficient manner possible.

MANAGEMENT

- o Deadlines: Establish and meet commitments to effectively implement key provisions of the Act.
- o Team Effort: Work together; attract and retain a diverse and talented workforce.

C H A R T I I I

VOC CONTENT OF NAVY PAINTS

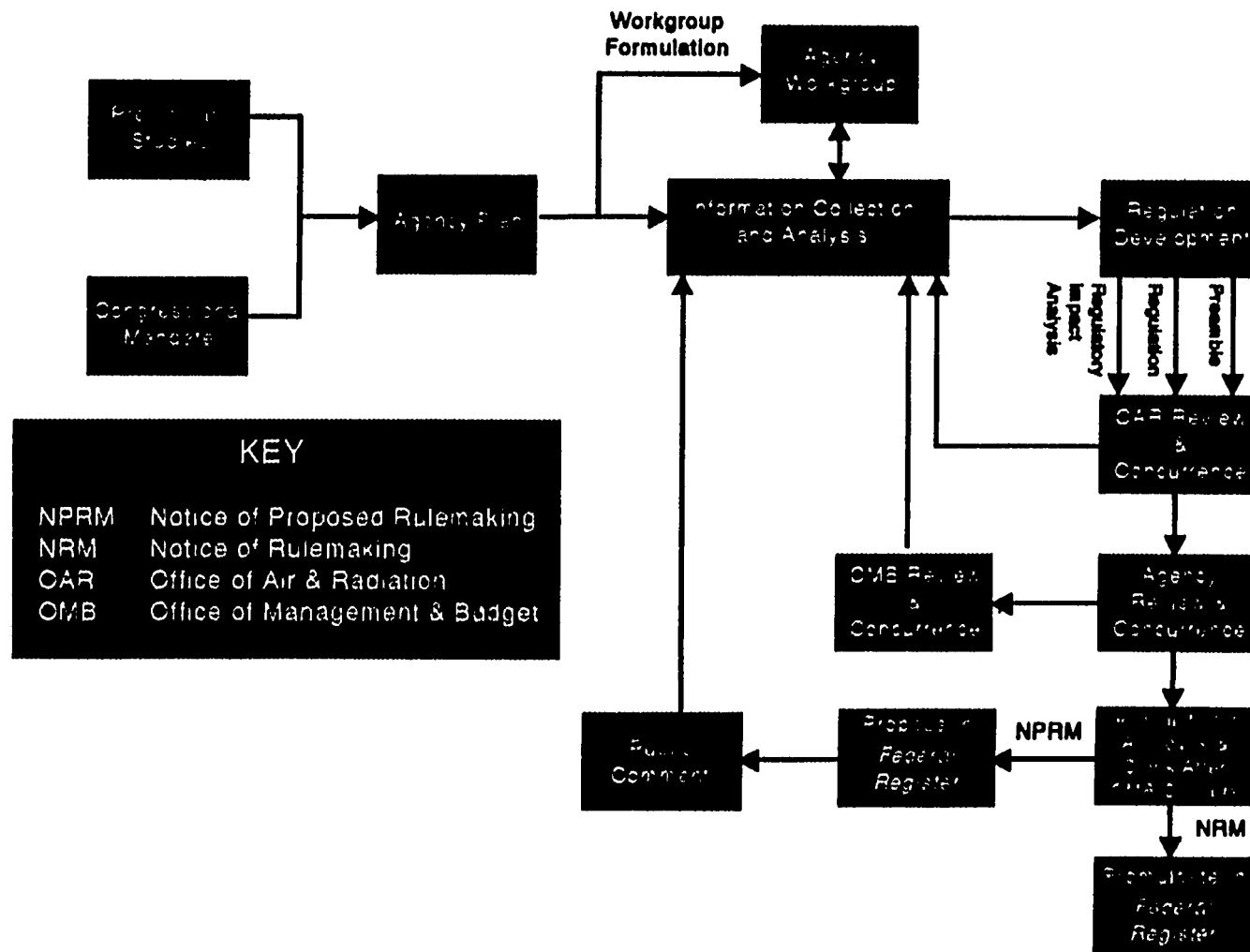
● Types Most Widely Used

	VOC CONTENTS (g/L)	TARGET
- Alkyd Coatings * Ship's Interior and Exterior Freeboard	380 - 780	340
- Epoxy Coatings * Exterior, Interior, & Immersion Areas	200 - 410	340
- Copper Based Anti- fouling Coatings * Underwater Hull Surfaces	283-440	440/340

CHART IV

CHART V

REGUALTORY DEVELOPMENT OVERVIEW



AIR QUALITY TACTIC RANKING

CHART VI

Src ¹	Tactic	Pollutant	Emission (tons/day)	Reduction (tons/day)	% Reduction	% 87 ² Reduction	cost ³	TF ⁴	R ⁵	Ent ⁶	T ⁷	E ⁸	C ⁹	A ¹⁰	IA ¹¹
I	Fiberglass Mfg.	NOG	1.30	1.05	56%	0.51%	\$0.005	H	H	H	-	0	0	N/E	APCD
I	Substitute Cleanup Solvents	NOG	0.96	0.73	76%	0.35%	\$0.15	H	H	H	+	0	+	N/E	APCD
I	Methanol/Diesel Engs	NOx	0.04	0.03	75%	0.01%	\$0.50	H-M	H	H	0	+	0	N	APCD
I	Plastic/Rubber Coatings	NOG	0.22	0.17	77%	0.08%	\$0.62	H	H	M/H	-	+	0	N/P	APCD
I	Boilers/LowNo+Burners	NOx	9.60	3.45	36%	1.67%	\$0.62	H	H-M	H	0	0	0	N/E	APCD
I	Boilers/Urea Injection	NOx	9.60	5.20	54%	2.52%	\$0.84	H	H-M	H	0	0	0	N/E	APCD
A	Deodorants	NOG	20.70	0.34	2%	0.16%	\$0.85	H	H	H	0	0	0	N	ARB
I	Foam Blowing/Plastics	NOG	0.25	0.2	80%	0.10%	\$0.90	H-M	H	H	-	0	-	N/E	APCD
I	Adhesives	NOG	0.31	0.22	71%	0.11%	\$1.00	H	H	H	+	+	0	N/E	APCD
I	Petroleum Dry Cleaners	NOG	0.16	0.1	63%	0.06%	\$1.02	H	H	H	+	0	0	N/E	APCD
I	Kelp Processing Ops.	NOG	0.35	0.17	49%	0.06%	\$1.02	H	H	H	0	+	0	N/E	APCD
I	Paint&Lak Manufacturing	NOG	0.71	0.48	68%	0.23%	\$1.06	H	H	H	0	+	0	N/E	APCD
I	Boilers/selective Non-Cat	NO+	9.60	4.32	45%	2.10%	\$1.10	H	H-M	H	0	0	0	N/E	APCD
I	Metal parts/ Products Ctg *	NOG	1.78	0.56	31%	0.27%	\$1.19	H	H-M	M	+	0	0	N/E	APCD
I	Coatings, Can&Coil	NOG	0.39	0.31	79%	0.15%	\$1.33	H	H	H	0	+	0	N/E	APCD
A	low No+Residential Water Heaters	NOx	4.64	2.46	53%	1.19%	\$1.53	H	H	H	0	0	0	N/E	APCD
I	Boilers/Flue Gas Recirc	NO+	9.60	2.22	23%	1.06%	\$1.96	H	H-M	H	0	0	0	N/E	APCD

1 Src - Source Type I=Industrial A=Areawkk T=Transportation M=Mobile

2 %ofProduction-Percent reduction in the draft 1987 Buisson Inventory

3 Cost-Cost-Effectiveness, in \$/Pound

4 TF-Technical Feasibility: H=High M=Medium N=Nominal

5 R - Reliability: H=High M=Medium N=Nominal

6 Ent=Enforceability: H=High M=Medium N=Nominal

7 T - Toxic Emission impact: +=Possible increase o=No known impact -=Possible decrease

8 E- Energy Demand Impact+=Possible increase O=No known impact -=Possible decrease

9 C- CPC (Freon/Halon) Impact: +=Possible increase O= NO known impact -=Possible decrease

10 A - Applicability: N=New sources E=Existing sources

11 1A - Implementing Agency: APCD=Air Pollution Control District ARB=California Air Resources Board EPA=US Environmental Protection Agency

¹ Indicates tactic adoption anticipated prior to revised regional air quality strategy submittal to ARB

AIR QUALITY TACTIC RANKING

CHART VII

Src ¹	Tactic	Pollutant	Emissions (tons/day)	Reduction (tons/day)	% Reduction	% 87 ² Reduction	Cost ³	TF ⁴	R ⁵	Enf ⁶	T ⁷	E ⁸	C ⁹	A ¹⁰	IA ¹¹
A	Commercial Charbroiling	PM	2.42	2.08	86%	0.42%	\$2.05	H	H	H	-	+	o	N/E	APCD
A	Commercial Charbroiling	ROG	0.61	0.52	85%	0.25%	\$2.05	H	H	H	-	+	o	N/E	APCD
I	Boilers/LNB&FCR	NOx	9.60	5.17	54%	2.51%	\$2.20	H	H-M	H	o	o	o	N/E	APCD
A	Bakeries	ROG	0.28	0.22	79%	0.11%	\$3.30	H	H	H	o	+	o	N/E	APCD
I	Boilers/Selective Cat Red	NOx	9.60	7.37	77%	3.58%	\$3.94	H	H-M	H	o	o	o	N/E	APCD
A	Marine Pooling Operations	ROG	0.03	0.02	67%	0.01%	\$4.13	H	H	H	-	+	o	N/E	APCD
I	Semiconductor Mfg.	ROG	0.28	0.07	25%	0.03%	\$4.45	H	H	H	+	o	+	N/E	APCD
I	Methanol/Large Boilers	NOx	9.63	3.28	34%	1.59%	\$4.50	M	H	H	o	+	o	N/E	APCD
I	Methanol/Gas Turbines	NOx	10.00	3.4	34%	1.65%	\$4.50	M	H	H	o	+	o	N/E	APCD
I	Nat Gas Only/Comb Equip	CO	0.54	0.18	33%	0.02%	\$6.72	H-M	H-M	H	o/+	o	o	N/E	APCD
I	Nat Gas Only/Comb Equip	NOx	4.04	1.66	41%	0.81%	\$6.72	H-M	H-M	H	o/+	o	o	N/E	APCD
I	Nat Gas Only/Comb Equip	PM	1.14	1.05	92%	0.21%	\$6.72	H-M	H-M	H	o/+	o	o	N/E	APCD
I	Nat Gas Only/Comb Equip	ROG	0.09	0.09	100%	0.04%	\$6.72	H-M	H-M	H	o/+	o	o	N/E	APCD
I	Nat Gas Only/Comb Equip	SOx	5.96	5.66	95%	3.40%	\$6.72	H-M	H-M	H	o/+	o	o	N/E	APCD
A	Low NOx Commercial Water Heaters	NOx	0.21	0.11	50%	0.05%	\$6.92	H	H	H	o	o	o	N/E	APCD
A	Soil Decontamination	ROG	0.58	0.5	86%	0.24%	\$9.71	H	H	M-H	-	o	o	N	APCD
A	Gas Tank Decommissioning	ROG	0.05	0.04	86%	0.02%	\$10.00	H	H	M-H	-	o	o	N	APCD
I	Further Fiberglass Control	ROG	0.61	0.34	56%	0.16%	\$11.44	H-M	H	H-M	-	o	o	N/E	APCD

1. Src - Source Type: I=Industrial A=Area-wide T=Transportation M=Mobile

2. % 87 Reduction - Percent reduction in the draft 1987 Emission Inventory

3. Cost - Cost Effectiveness, in \$/pound

4. TF - Technical Feasibility: H=High M=Medium N=Nominal

5. R - Reliability: H=High M=Medium N=Nominal

6. Enf - Enforceability: H=High M=Medium N=Nominal

7. T - Toxic Emission Impact: +=Possible increase o=No known impact --Possible decrease

8. E - Energy Demand Impact: +=Possible increase o=No known impact --Possible decrease

9. C - CFC (Freon/Halon) Impact: +=Possible increase o=No known impact --Possible decrease

10. A - Applicability: N=New sources E=Existing sources

11. IA - Implementing Agency: APCD=Air Pollution Control District ARB=California Air Resources Board EPA=US Environmental Protection Agency

* Indicates tactic adoption anticipated prior to revised regional air quality strategy submittal to ARB

AIR QUALITY TACTIC RANKING

Src ¹	Tactic	Pollutant	Emissions (tons/day)	Reduction (tons/day)	% Reduction	% 87 ² Reduction	Cost ³	TF ⁴	R ⁵	Enf ⁶	T ⁷	E ⁸	C ⁹	A ¹⁰	IA ¹¹
I	Petrol Stor Task Degaasing	ROG	1.90	1.70	89%	<0.01 %	\$11.55	H	H-M	H	-	+	0	N/E	APCD
A	Air striping-Groundwater	ROG	<0.01	<0.01	86%	<0.01 %	\$15.88	H	H	M-H	-	0	0	N	APCD
I	Fuel Cells/Ic Begins	NOx	0.01	0.01	94%	0.00%	\$66.00	L	H	H	0	0	0	N/E	APCD
A	Residential Solar Hot water-New Eidge	NOx	4.64	0.00	53%	0.00%	\$84.00	H	H	H	0	+	0	N	APCD
A	Residential Seter Hot Water-Retrofit	NOx	4.64	1.03	53%	0.01 %	\$89.00	H	H	M-H	0	+	0	E	APCD
I	EtO Sterilizers	ROG	0.06	0.05	83%	0.02%	\$90.00	H	H	H	-	+	0	N/E	APCD
A	Commercial Solar Hot Water-New Eidge	NOx	0.21	0.00	53%	0.00%	\$260	H	H	H	0	+	0	N	APCD
I	Fuel Cella/Utility Boilers	NOx	9.63	9.44	96%	4.58%	\$1,040	L	H	H	0	0	0	N/E	APCD
I	Coadings, wood Furniture	ROG	0.40	0.28	70%	0.14%	Sav- \$18.34	H-M	H	H	0	+	0	N/E	APCD
I	solvent Cleaning Ops.	ROG	5.56	1.06	19%	0.51%	Sav- \$3.85	H	H-M	H-M	-	+	-	N/E	APCD
I	Marine Coatings'	ROG	2.29	0.5	22%	0.24%	Sav- \$6.40	H-M	H-M	H-M	+	0	0	N/E	APCD
A	Coatings, Architectural'	ROG	14.30	0.37	3%	0.18%	Sav- \$6.40	M	H	H	0	0	0	N/E	APCD
A	Solar Pool Heaters - New	NOx	0.27	0.00	100%	0.00%	Save	H	H	M-H	0	+	0	N	APCD

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2 % 87 Reduction - Percent reduction in the draft 1987 Emission Inventory

3 Cost - Cost Effectiveness, in \$/pound

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5 R - Reliability: H=High M=Medium N=Nominal

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CHART VIII

AIR QUALITY TACTIC RANKING

CHART IX

Src ¹	Tactic	Pollutant	Emissions (tons/day)	Reduction (tons/day)	% Reduction	% 87 ² Reduction	Cost ³	TF ⁴	R ⁵	Enf ⁶	T ⁷	E ⁸	C ⁹	A ¹⁰	IA ¹¹
A	Solar Pool Heaters - Retro	NOx	0.27	0.19	100%	<0.01%	Save	H	H	M-H	o	+	o	E	APCD
I	Auto Refinishing	ROG	2.19	1.31	60%	0.63%	Save	H-M	H-M	M	+	+	o	N/E	APCD
A	B-B-Q Lighter Fluid	ROG	0.44	0.33	74%	0.16%	Save	H	H	H	-	o	o	N/E	APCD
I	Radiant Burners (<10MM)	NOx													
I	Low Temp SCR/Res Rcvry	NOx													
I	SCR for Lean Burn, & retro	NOx													
I	Aromatic Content Limits	NOx													
A	Low NOx Space Heaters	NOx													
A	Heat Transfer Modules	NOx													
A	Utility Equipment	NOx													
A	Electrify Ship Berthing	NOx													
A	Pleasure Craft Standards	NOx													
I	Coatings, Discs	ROG													
A	Domestic Products	ROG													
A	Fail-Safe Phase I VRS	ROG													
A	Marine Vessel Lightering	ROG													
A	Emission Fee for Variances	ROG													
A	Time Specific Emission Fees	ROG													

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